Chapter 11

Using Phonically Based E-books to Develop Reading Fluency

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Additional information is available at the end of the chapter

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Abstract

The purpose of this chapter is to describe the 'Tales of Jud the Rat' reading fluency programme and its logic, and to present preliminary results from its use as a form of e-learning. The first section of the chapter provides an overview of the development of the 'The Tales Jud the Rat' series. Literature relevant to the neurolinguistic basis of the materials is then reviewed. Results from initial case study and the first cohort of children who have worked on this programme with their parents are presented in the third section, while the final section of the chapter provides an evaluation of the current status of the programme and indicates its potential uses.

At this stage in the development of the programme, there is plenty of material available, and the ebooks and supporting methodology are currently being used by the parents, therapists and teachers of over seventy children with reading difficulty across our country. Some of the children live over a thousand kilometres from my rooms. Others are in schools or clinics. The results have been promising both with primary school children as well as with adolescents in high school. Parents, therapists, teachers and children have also provided positive evaluations of the effects improved reading fluency has had on reading ability more generally, as well as on school work.

Keywords: Reading difficulties, dyslexia, reading fluency, rate of work, structured phonics, analytical phonics, seven vowel system, large print, ebooks, visual tracking, 3 × 3 oral impress method, distance education

1. Introduction

'Learning to read requires mastering the system by which print encodes the language.' [1]

I am an educational psychologist who specialises in work with children with learning and reading difficulties. As part of this work, I have been developing a reading fluency programme based on a series of ebooks.

The text of the ebooks has been written based on neurolinguistic theory[1], and the ebooks are designed to be used with a form of oral impress procedure based on paired reading. This is simple to implement. It differs from the type of paired reading procedures documented in the literature, as it involves additional repetition to develop phonic associations and automaticity in reading.

The ebooks are set in large print with wide spaces between words to provide maximal visual cues and also to prevent crowding, which has emerged in recent literature as a factor affecting reading in dyslexic children. The oral impress procedure also builds in visual tracking to maintain visual attention. Repetition on both the phonological and the visual level is thus provided both in the text of the ebooks as well as in the procedures used to work with the children. Visual attention is maintained through the use of a pointer working from the top of the line, and not from the bottom, for the reason that the top of the line provides greater visual cues than the bottom of the line.

As the materials are in electronic form, they provide a form of e-learning which can be used in contact, as well as at distance. The ebooks are designed to be used by parents and can also be used by therapists, teachers and schools to develop fluent reading. Assessment and evaluation are built into the programme's structure, linked to an awards system for children using the materials.

This chapter is written in three parts. The first part of the chapter presents a literature review. The second part describes the development of the characters and setting of a set of reading materials called 'The Doctor Skunk Stories', which were developed for a child who lived some 6,000 miles away from my rooms. This part of the chapter is based on a longitudinal case study. The third part of the chapter then describes the subsequent development of the materials into an assessment-based reading programme and presents results of the first cohort of children who have worked on this programme with their parents.

At this stage in the development of the programme, there is plenty of material available, and the ebooks and supporting methodology are currently being used by the parents, therapists and teachers of over seventy children with reading difficulty across our country. Some of the children live over a thousand kilometres from my rooms. Others are in schools or clinics. The results have been promising with younger children as well as adolescents. Parents, therapists, teachers and children have also provided positive evaluations of the benefits improved reading fluency has had on reading ability more generally, as well as on school work.

1 The approach to automaticity in reading adopted in this chapter is based on the work of the Russian neuropsychologist A.R. Luria, and the term "neurolinguistic" follows Luria's work on the physiological basis of language-based functions (Luria, A.R. (1976). Basic Problems of Neurolinguistics. The Hague: Mouton B.V.) as well as the approach suggested by Arbib and Caplan of the Center for Systems Neuroscience at the University of Massachusetts, Amherst (Arbib, M.A. and Caplan, D . (1979). Neurolinguistics must be computational. Behavioral and Brain Sciences, 2, 3, pages 449- 460) in which neurolinguistics draws insights from modern neuroanatomy, neurochemistry and neurophysiology.

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2. Literature on automaticity in reading

2.1. Orientation

The literature on reading is complex on a theoretical level, and it is impossible in a short literature review to do justice to this. I have thus written the first section of the literature review which deals with automaticity in reading from a functional and applied perspective, and would refer readers interested in psycholinguistic theories of reading to a good source, such as Adams [2] or Perfetti [3, 4, 5].

The definitions of the terms I am going to provide at the beginning of this chapter are functional ones for the reason that the first stage in development of 'The Tales of Jud the Rat' materials was based on applied work conducted over a number of years with one child. As these initial materials were used by a parent and a peer tutor implementer working in Europe, 6,000 miles away from my rooms in Johannesburg, the initial literature I am going to review is based on research on reading fluency programmes implemented through parent and peer-tutored paired reading. This is followed by review of the neurolinguistic literature which has provided the theoretical basis for the development of the 'The Tales of Jud the Rat' materials in their current form.

2.2. Definition of terms

Reading decoding involves a child or adult's ability to read words both individually and in sequence. This involves the ability to use sound–letter associations to sound out individual words by analysing their parts and then to link these parts together to form words. The process of analysis and synthesis of individual words then needs to be done sequentially, with sufficient fluency to comprehend both the individual words and strings of words being read.

Fluent reading involves the ability to decode individual words and join the parts together quickly and accurately, so that the words can be understood both individually and in sequence. Cognitive processes of perception, language, sequencing and working memory are involved in fluent reading, and for this reason, assessment of reading also involves side-by-side assessment of perceptual, language, working memory and sequential abilities.

Reading can be defined as a complex cognitive process of making meaning from text, which depends on adequately developed perception, language, working memory and sequential abilities. As reading comprehension is affected by reading fluency, reading fluency can be defined as:

'The ability to read phrases and sentences smoothly and quickly, while understanding them as expressions of complete ideas.' [6]

Smooth, quick reading is based on the notion of automaticity [7], which underpins the abilities to read with speed and accuracy as well as expression. Automaticity is developed in reading when there has been sufficient practice to enable a complex functional act to become fluent enough to form the basis for higher mental processing. As Logsdon [8] suggests:

'Reading fluency refers to the ability to read with adequate accuracy, speed, expression, and automaticity. Reading fluency is very important to one's overall ability to understand, or comprehend, what is read.'

2.3. Automaticity in reading

On a theoretical level, automaticity in reading is based on the suggestions made by Luria [9] concerning the development of automaticity in the hierarchical processing of information by the working brain. LaBerge and Samuels [10] were the first researchers to focus on automaticity as a function of how reading fluency develops. They proposed a model of information processing in reading, in which visual information is transformed through a series of processing stages involving visual, phonological and episodic memory systems until it is finally comprehended in the semantic system.

LaBerge and Samuels further proposed that the processing occurring at each processing stage was learned while the degree of learning could be assessed with respect to two criteria: *accuracy* and *automaticity*. At the accuracy level of performance, attention was assumed to be necessary for processing; at the automatic level, it was not.

Again following Luria [11], who had suggested the value of repeated modelling and practice in developing automaticity in writing, Samuels suggested that automaticity in reading could be trained through procedures involving repeated reading, As Samuels commented,

'It is important to point out that repeated reading is not a method for teaching all reading skills. Rather, it is intended as a supplement in a developmental reading program. While the method is particularly suitable for students with special learning problems, it is useful for normal children as well.' [12]

Support for LaBerge and Samuels' work was provided independently by Carol Chomsky [13] at Harvard University. Chomsky concluded that the repeated reading procedure she had used with students had been facilitating for both slow and halting readers, 'increasing fluency rapidly and with apparent ease'. Other researchers such as Carbo [14], Morgan and Lyon [15] and Ashby-Davis [16] provided additional support through studies using different repeated reading methods to model and develop automaticity through repetition.

The goal of each of these different studies was the development of reading fluency, which Allington [17] pointed out was a characteristic of poor readers, but was seldom treated. The notion of fluency has then recurred in subsequent literature. Adams [18], for example, has suggested that the most salient characteristic of skillful reading is the speed with which text is reproduced into spoken language.

Fluency is thus associated with oral reading. Fuchs et al. [19] have defined oral reading fluency as the oral translation of text with speed and accuracy. On the basis of review of theoretical arguments and several studies substantiating this phenomenon, Fuchs et al. concluded that oral reading fluency is an indicator of overall reading competence.

The U.S. Congress [20] has defined the essential components of reading instruction as involving explicit and systematic instruction in:

a. phonemic awareness;

b. phonics;

c. vocabulary development;

d. reading fluency, including oral reading skills; and

e. reading comprehension strategies.

(SEC. 1208. DEFINITIONS).

There would thus be justification for incorporating the assessment of reading fluency as one aspect of psychometric measurement of reading, with implications for both research and practice based on assessment of reading ability (e.g. [21]).

2.4. Developing reading fluency through paired reading methods

The literature suggests that reading fluency can be developed by paired reading methods, which have been described differently by different researchers. Carol Chomsky [22] called the technique 'repeated reading'. Carbo [23] used tape-recorded books with struggling readers to good effect and called her method 'talking books'. Morgan and Lyon [24] called their technique 'paired reading', while Ashby-Davis [25] called her method 'assisted reading'. Other terms used by researchers include 'neurological impress' [26, 27, 28] and 'reading by immersion' [29].

The use of these different terms would suggest that paired reading is an umbrella term, in which there are a number of variations in method. For this reason, I have used the term '3 × 3 oral impress method' to describe the procedure for paired oral reading I have developed, as the method I use differs from the strategies for developing reading fluency used in the studies reviewed in the rest of this section.

The earliest study indicating the value of paired reading in a classroom setting was conducted by Heckelman [30, 31], who reported that 24 students involved in using what he called 'the neurological impress method' made exceptional gains in reading ability. The mean gain in reading comprehension was 1.9 grade levels after using the method daily for 15 min (a total of seven and a quarter hours) over a 6-week period. Heckelman hypothesised that this method was 'one of the most direct and fundamental systems of reading' involving a 'combination of reflexive neurological systems'.

Hollingsworth [32] also reported positive results from the use of an impress method in teaching reading and defined impress or neurological impress techniques as the use of unison reading methods in which teacher and student read aloud simultaneously. No attention would be called to the pictures accompanying the story, nor would the teacher attempt to teach sounds of words or word recognition skills.

Morgan and Lyon [33] involved parents in the process of providing tuition for children with reading difficulties and called the technique 'paired reading'. In Morgan and Lyon's study, the paired reading tuition procedure was described as a simple and flexible remedial technique for general application, incorporating simultaneous reading and verbally reinforced individ-

ual reading, and utilising textual material suited to the child's interests and chronological age rather than his reading age.

In Morgan and Lyon's study, the parents of four reading-retarded children were trained in how to provide paired reading tuition at home for a quarter of an hour daily. Over 12 to 13 weeks of tuition, the group's reading ages improved markedly. Marked advances in reading comprehension were also noted.

The researcher who has done most to promote and popularise paired reading methods, however, has been Topping [34–37], who has been Professor of Educational Psychology and Director of the Centre for Paired Learning at the University of Dundee. Topping's Centre has focused in particular on the development and evaluation of the effectiveness of methods for non-professionals (such as parents or peer tutors) in providing support in the acquisition of basic skills in reading, spelling, writing, science, maths and information technology. As part of this work, Topping has published widely on paired reading as well as peer tutoring and other forms of cooperative learning.

Topping [38] focused on the value of paired reading in the context of a large-scale dissemination project, and reported on the instructional procedures and outcomes from ten different peer tutoring projects. Pre-and post-test data were reported for all these ten evaluative studies. Four of the studies also provided baseline data and two studies provided comparison group data. Two studies then provided follow-up data for the short and long term respectively.

The evidence reviewed under these different conditions suggested that peer tutored paired reading accelerated children's reading progress in all these settings. All children were reported to have made progress, with peer tutors gaining more than tutees. On the basis of these positive results, Topping [39] also suggested that peer tutoring and paired reading were two potentially powerful techniques which could be combined, and that structured pair work between children of different ability had great potential for effective cooperative learning. Good organisation by the teacher was the key.

2.5. Parent involvement in paired reading

Based on the work of a number of paired reading programmes, Topping [40] suggested that paired reading methods provided an ideal way for teachers to involve parents in the process of developing reading competence. He also wrote a handbook [41] indicating ways in which parents could use paired work with their children to develop basic skills in reading, spelling and writing.

In addition, Topping reported the results of a number of studies indicating the effects of paired reading on reading ability based on reading age gains relative to increase in chronological age [42–44]. Based on analysis of results of 18 studies which focused on the effects of paired reading, Topping concluded that variables such as the duration of the intervention period and the acceleration of learning did not affect the results. In addition, based on analysis of the results of projects which included follow-up data and as there were no reports to the contrary in any of the other studies, Topping concluded that gains in reading ability appeared to be sustained.

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Other researchers have also indicated the value of parental involvement in children's reading. Morgan and Lyon [45] described paired reading tuition procedure as a simple and flexible remedial technique which incorporated simultaneous reading and verbally reinforced individual reading. Parents could be trained to use the method. Hewison and Tizard [46] reported that the factor which emerged as most strongly related to reading achievement was whether or not the mother regularly heard the child read. IQ differences did not account for the superior reading performance of the coached children. Maternal language behaviour also had little effect on the association between coaching and reading performance. The important variable was the amount of parental coaching received by the children, which had a highly significant positive association with reading test scores.

In addition, there has been evidence of the value of paired reading programmes involving parents cross-culturally. Vanwagenen, Williams and Mclaughlin [47] reported positive effects of assisted reading on reading rate, accuracy and comprehension on three 12-year-old Spanish-speaking children learning English, while in South Africa, Overett and Donald [48] trained 29 parents from low socio-economic backgrounds to use a paired reading technique. Overett and Donald then compared their results with those of a control group composed of 32 parents. The results indicated a statistically significant increase for the experimental group, with statistically significant improvements in reading accuracy and comprehension, as well as reading attitude and involvement. A broader ecosystemic analysis was also conducted, which suggested that positive relationships between children and significant others in the family were nurtured and other children in the family were benefiting. Interactions between family and school, and school and the local community library were also enhanced.

Positive results have also been reported in other cultural contexts. In Hong Kong, Lam et al. [49] involved parents in paired reading with pre-schoolers, working with 195 preschoolers (mean age = 4.7 years) and their parents. The sample was drawn from families with a wide range of family income, and the preschoolers were then randomly assigned to experimental and control groups.

Training was provided to the parents in the experimental group, who received 12 sessions of school-based training on paired reading over a period of 7 weeks. These parents were then asked to do paired reading with their children at least four times a week in each of these 7 weeks.

At the end of the 7-week intervention, Lam et al. reported that the children in the experimental group had better performance in word recognition and reading fluency than their counterparts in the control group. The children who had been exposed to paired reading were also reported as more competent and motivated in reading by their parents.

In addition, parental changes in relationships and self-efficacy were found to mediate the impact of the intervention on some of the child's outcomes. Lam et al. reported that the parents in the experimental group had higher self-efficacy in helping their children to be better readers and learners, and that these parents also had better relationships with their children. However, family income did not moderate the effectiveness of the programme, with families with high and low income deriving similar benefits from the programme.

2.6. Are parents and peer tutors effective in assisting their children to learn to read?

Overall, the literature reviewed in this section would suggest that both practice and modelling of the reading process by a competent reader are important in paired reading. Repetition is also a crucial factor, especially in working with children with reading or reading fluency difficulties. Parents as well as peer tutors can be used to provide support to struggling readers for the reason that it is the contact, support and modelling of the reading process which are important factors as opposed to variations in implementation of paired reading procedure. Organisation and clear direction are also important factors in implementing a successful paired reading programme.

In their review of the literature on paired reading, Cadieux and Boudreault [50] concluded that paired reading is an effective means of improving reading performance and that nothing indicates that reading gains made through paired reading are not sustained over time. Those studies which have examined processes demonstrate variable levels of compliance with the paired reading technique. However, this factor does not appear to be closely linked with reading gains.

There is also a wider literature supporting parental involvement in assisting their children to read. Hannon, Jackson and Weinberger [51] reported considerable similarities between the parents' and teachers' strategies in terms of the relative frequencies with which they made different kinds of responses while hearing their children read. The most frequent responses for each group were providing words or giving directions about reading, with a greater proportion of parents' responses being made after reading mistakes or miscues, while teachers were likely to make responses both after reading mistakes or miscues, as well as at other times.

Hannon, Jackson and Weinberger reported that both parents and teachers used phonic techniques in responding to reading mistakes or miscues. For parents, this usually meant 'sounding out' words, while for teachers this meant a wider range of responses. Both parents and teachers focused on children's understanding, but for the parents this was generally in response to reading mistakes or miscues, while for teachers this was generally to establish that what the children had read had been comprehended. Hannon, Jackson and Weinberger reported differences in the pattern of positive feedback, praise and criticism between parents and teachers but suggested that these could be due to differences in the social context of reading in the parent and school settings.

Overall, Hannon, Jackson and Weinberger concluded that no justification exists for considering that parents are incompetent in working with their children in developing reading ability. They also concluded that there was scope for reviewing the roles of both parents and teachers in developing reading competence in early childhood education, and this could be facilitated by further research.

Ellis [52] utilised a pre-test/post-test experimental design to investigate the effects of a 12-week parent and child reading intervention on the reading ability and self-perceptions of reading ability in second- and third-grade students. Twenty parents, randomly assigned to the experimental group, participated in the weekly programme sessions. The sessions emphasised

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simple techniques that parents could use at home to help their child in reading, such as relaxed reading, paired reading and praise and encouragement.

Ellis reported significantly greater improvements in reading as measured by the number of errors made on graded passages for the experimental group. No significantly greater improvements were made by the experimental group in terms of the number of errors made on graded word lists or graded comprehension questions, or in self-perceptions of reading ability. Overall, the findings supported the notion of parental involvement in reading to improve reading ability.

2.7. Type and difficulty level of materials used in paired reading

The literature is not as clear on the type of reading materials to use in paired reading programmes, and also reflects different opinions on difficulty level of materials in paired reading. Carol Chomsky [53] reported that struggling readers decoded slowly and with difficulty and that, despite their hard-won decoding skills, they were also passive to reading. Chomsky recommended that what was needed was material which would engage attention and also make large amounts of textual material available.

Other researchers have used taped books in paired reading (e.g. [54]), or instructional level materials (e.g. [55]). Based on Wasik's review of volunteer tutoring programmes in reading [56], Cadieux and Boudreault gave a standard material package of instructional level material to all participants in their study of paired reading, which was based on available materials reflecting the type and progression of instruction in reading and word attack skills received in school. The package included flash cards containing phonograms (letters, consonant–vowel syllables and consonant–vowel–consonant syllables) which were used for letter reading and syllable recognition activities, as well as first-grade books containing illustrations which were used to practice reading using text. The children received two or three books at each tutoring session, chosen to suit the level of the reading abilities of the child and parent.

In contrast, Deegan [57] has suggested that the student and teacher should select a text that is near frustration level reading and around 200 words in length. Deegan has also suggested that textual characteristics influence the effectiveness of paired reading and that rhythmic and repetitive texts can increase student participation.

Given difference of opinion relating to difficulty level, Morgan, Wilcox and Eldredge's [58] study is of particular interest. These researchers investigated the effect of difficulty levels on second-grade delayed readers using dyad reading, with the aim of establishing how far above a poor reader's instructional level dyad reading should be conducted. The aim was to establish which level of difficulty was associated with the greatest improvement in reading level, word recognition, comprehension and rate. In their study, 51 poor readers were randomly assigned to three experimental groups: (a) dyad reading using materials at their instructional reading level, (b) dyad reading using materials which were two grades above their reading level and (c) dyad reading using materials which were four grades above their reading level. The research was conducted over 95 sessions, with all groups involved in paired reading for 15 min daily during their classroom reading time.

At the end of the school year, Morgan, Wilcox and Eldredge compared reading gain scores of the three groups. They also compared the post-test scores for word recognition, comprehension and reading rate for each group. No significant differences were found between classrooms. The results indicated that all three groups had made gains in reading skills regardless of the difficulty level of the materials used. The second and third groups which read material significantly above their reading level made greater gains than those reading at their instructional level.

Morgan, Wilcox and Eldredge reported that those students who were assisted in reading material two years above their level made the greatest gains. From informal observations, it appeared that poor readers in the third group (i.e. poor readers reading difficult material) seemed to be less motivated to read books four years above their reading level. Morgan, Wilcox and Eldredge commented that these books had significantly less pictures and more words and the children did not seem ready to make the transition from picture books to chapter books. At this level of difficulty, some students appeared to be turned off and paid less attention.

Overall, while all the children improved with dyad reading regardless of the difficulty levels of materials, the results suggested that the difficulty level of materials used for dyad reading may make a difference in student progress. The researchers did not indicate the exact point at which frustration defeated the purpose of paired reading, but suggested that additional research was needed to establish this. Nevertheless, Morgan, Wilcox and Eldredge concluded that children did not have to be taught with instruction-level materials. Poor readers appeared to improve significantly more when they read with a partner at higher levels that exposed them to more unknown words and complex language structures. The results also indicated that to progress more rapidly, students need to be exposed to more difficult material.

Stahl and Heubach [59] reported the results of a 2-year project in which they re-organised the basal reading instruction provided in 14 classes so as to stress fluent reading and automatic word recognition. The reorganised reading programme consisted of three parts: a basal reading lesson which included repeated reading and partner reading, a choice reading period during the day and a home reading programme. The reorganised reading programme was then implemented over a period of 2 years.

Stahl and Heubach reported that the children in all 14 classes made significantly greater than expected growth in reading achievement. All but two children who entered second grade were reading at grade level or higher by the end of the year, while growth in fluency and accuracy appeared to be consistent, reflecting over the whole year. Students' and teachers' attitudes towards the programme were also positive.

In evaluating the contribution of the different components in their programme, Stahl and Heubach reported that self-selected reading partners appeared to work best. Children chose partners primarily out of friendship, and tended to choose books that were at or slightly below their instructional level. However, children in the study also benefited from more difficult materials, provided that scaffolding and support were provided.

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2.8. Implications

The literature on paired reading reviewed in this section reflects some differences in preferred methodology, as well as some difference between recommendations concerning the type of materials felt to be most appropriate for use in the process. Overall, however, there would appear to be consensus concerning the value of paired reading, with all of the studies indicating the potential of including parents as well as peer tutors as partners in the process of teaching children to read fluently.

In many of the studies reviewed in this section, paired reading showed positive results on reading fluency over a relatively short period of time. In addition to effects at the reading fluency level, transfer effects of paired reading into reading comprehension were also noted. This would suggest benefits from paired reading methods not only at the level of automaticity (i.e. on speed and accuracy of reading) but also on the higher-level cognitive processes involved in comprehension.

There are also areas of lack of clarity in the literature. Difficulty level of materials would be an important variable to consider in developing paired reading programmes. Certain authorities suggest the value of fun reading materials, others the value of instructional level reading materials and others the value of reading material chosen to be at or near frustration level. There is thus a lack of consensus in this area.

What is clear from the literature, however, is that quality of scaffolding and support in paired reading is important, especially where difficult materials are chosen for use in paired reading programmes. How reading errors are corrected would appear to be less important, as the literature suggests that a wide variety of strategies have been used for doing so, particularly by teachers. It would, however, be important that the procedures used in paired reading are clear enough to be consistently used by parents, tutors and teachers, and that recommended procedures for correcting the errors made by children are also defined.

Overall, it would also be important to stress that while paired reading methods have potential value for developing reading fluency, other methods have also produced positive results. A study by Homan, Klesius and Hite [60], for example, compared repeated reading strategies with non-repetitive strategies on students' fluency and comprehension. In their study, they focused on the transfer effects of the previously mentioned procedures on both comprehension and fluency with sixth-grade students. Homan, Klesius and Hite's results indicated equivalent benefits for repetitive and non-repetitive methods, with significant comprehension improvement over a 7-week period.

Similarly, working in a developing country context, Shah-Wundenberg, Wyse and Chaplain [61] investigated parental support for children's reading of English in an inner-city school in India. The children in the study had oral proficiency in the regional language but were beginning to acquire conventional forms of literacy in English. A quasi-experimental design involving a sample of 241 children was used to evaluate the effectiveness of two approaches to parents supporting reading: paired reading and hearing reading. Interviews and observations with a smaller sub-sample of parents and children were also used to explore the implications of the data more deeply.

In Shah-Wundenberg, Wyse and Chaplain's study, paired reading and hearing reading were found to be equally effective in developing children's beginning English reading skills, reading accuracy and comprehension, relative to controls. The data also indicated that parents had engaged in a variety of mediation behaviours to enhance their children's English reading development. In addition, parents reported that participating in their children's reading in both conditions had been both enriching and empowering, suggesting that parental involvement can benefit children's English reading development.

The development of the reading fluency programme described in the rest of this chapter should thus be viewed as one of a number of potential approaches to enhancing the development of reading ability. Its potential advantages to parents, therapists, teachers and schools lie in the fact that it is based on a theory of structured phonics which has been developed with children who have had reading and spelling difficulties, that the material is delivered via the internet and email, and that the programme can be used at distance. 'The Tales of Jud the Rat' thus provides a form of e-learning which has the potential to enable paired reading methods to be used in a variety of contexts to develop fluent reading. There would also be potential for combining this programme with other instructional approaches [62].

3. Literature relevant to the Phonological Side of 'The Tales of Jud the Rat' reading fluency programme

3.1. Phonological and language correlates of reading ability

A wide variety of different studies have indicated an association between phonological and language development and reading ability. Based on meta-analysis of 61 samples of data, Scarborough [63, 64] reported that the highest average correlations and effect sizes were between measures requiring the processing of print (e.g. letter-sound knowledge) and reading ability, followed by measures of oral language proficiency (e.g. phonological awareness). There were a number of average predictive correlations above 0.50 and still more above 0.40, but of the oral language predictors, only phonological awareness was found to have a causal relationship with learning to read [65, 66].

Overall, the evidence from predictive research within the phonologically based paradigm was both convergent and compelling [67, 68, 69]. In addition, a number of neurolinguistic studies (e.g. [70, 71, 72]) indicated that dyslexic readers process written stimuli atypically, suggesting abnormal functioning of the left hemisphere reading system.

These neurolinguistic studies were of particular interest in suggesting particular areas of the brain associated with reading difficulties. Schulte-Körne and her colleagues [73] used mismatch negativity (MMN) to investigate the relationship between dyslexia and central auditory processing in 19 children with spelling disability and 15 controls at grades 5 and 6 level. While there were no group differences for tone stimuli, a significantly attenuated MMN was found in the dyslexic group for the speech stimuli, suggesting that dyslexics have a specific speech

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processing deficit at the sensory level which could be used to identify children at risk at an early age.

Shaywitz et al. [74] reported that learning to read requires phonological awareness, which can be defined as an awareness that spoken words can be decomposed into the phonologic constituents that the alphabetic characters represent. Phonological awareness is characteristically lacking in dyslexic readers, for the reason that dyslexic readers have difficulty in mapping alphabetic characters onto the phonologic constituents of the spoken word.

Shaywitz and her colleagues used functional magnetic resonance imaging (MRI) to compare brain activation patterns in dyslexic and non-impaired subjects as they performed tasks that made progressively greater demands on phonologic analysis. Brain activation patterns were found to differ significantly between the groups with dyslexic readers showing relative underactivation in posterior regions (Wernicke's area, the angular gyrus and striate cortex) and relative overactivation in an anterior region (inferior frontal gyrus). Shaywitz et al. thus concluded that the impairment in dyslexia is phonologic in nature and that brain activation patterns may provide a neural signature for this impairment.

Similar conclusions were reached by Brunswick et al. [75], who reported that dyslexic readers process written stimuli atypically, based on abnormal functioning of the left hemisphere reading system, and that the deficits are localised in the neural system underlying lexical retrieval. Klingberg et al. [76] used MRI analysis to examine the structure of white matter in dyslexic and normal adult readers and found differences between normal readers and individuals with poor reading ability. These differences occurred bilaterally in the temporo-parietal white matter underlying perisylvian cortical areas. An overlapping region in the left temporo-parietal white matter also yielded significant correlation between white matter microstructure and reading ability across all 17 subjects. This correlation was apparent both in the poor reading group and in the control group, indicating a structural neural correlate of reading skill in both normal and poor readers and also indicating that white matter underlying left temporo-parietal cortex plays a critical role in reading ability.

Burton [77] reported that there were functional sub-regions within the inferior frontal gyrus that correspond to specific components of phonological processing (e.g. orthographic to phonological conversion in reading, and segmentation in speech). Temple et al. [78] suggested that difficulties in reading are associated with both phonological and orthographic processing deficits, and that dyslexia may be characterised in childhood by disruptions in the neural bases of both phonological and orthographic processes important for reading.

In addition, the neurolinguistic literature indicated that a number of areas of the cortex were involved in fluent reading, as well as in processing different types of reading material. Bentin et al. [79] conducted research based on the analysis of event-related potentials (ERPs) elicited by visually presented lists of words. Based on this evidence, Bentin et al. concluded that different levels of processing are involved for visual, phonological/phonetic, phonological/lexical and semantic material in both hemispheres of the brain, and that a cascade-type process involving different but interconnected neural modules may be involved in the processing of print material, each responsible for a different level of processing of word-related information.

Similar conclusions were reached by Brown et al. [80] on the basis of examination of the MR images of 16 men with dyslexia and 14 control subjects, and comparison of these using a voxel-based analysis. Brown et al. reported evidence of decreases in gray matter in dyslexic subjects, not only in the left temporal lobe and bilaterally in the temporo–parieto–occipital juncture but also in the frontal lobe, caudate, thalamus and cerebellum. Brown et al. thus concluded that widely distributed morphologic differences affecting several brain regions may contribute to the deficits associated with dyslexia.

The above research thus suggested associations between impaired neurological processing and reading disability in dyslexic children. Equally important, however, were the indications from the neurolinguistic literature that reading difficulties were not immutable and that improvements in reading ability also had physiological correlates. Specifically, the development of reading ability would be accompanied by improvement in connectivity between the variety of cortical and sub-cortical centres involved in the reading process. These studies are reviewed in the following section.

3.2. The development of reading ability has correlates on a neurological level

A number of studies suggest that there are associations between the development of reading ability and improvement in neurological processing of print material. Patterns of central processing might initially not be well developed in dyslexic children, but would be responsive to instruction.

Simos et al. [81] studied magnetic source imaging scans during a pseudoword reading task with a sample of eight children aged from 7- to 17-years-old, both before and after 80 hours of intensive remedial instruction. All children were initially diagnosed with dyslexia, having severe difficulties in both word recognition and phonological processing. After remedial training, the dyslexia-specific brain activation profiles became normal, suggesting that change in central processing of print had occurred following intensive remedial training.

Shaywitz et al. [82] reported that provision of a phonologically mediated reading intervention over a period of a year improved both reading fluency and the development of the fast-paced occipito-temporal systems serving skilled reading. After the year-long intervention, children taught with the experimental intervention had made significant gains in reading fluency and demonstrated increased activation in left hemisphere regions, including the inferior frontal gyrus and the middle temporal gyrus, These improvements appeared to be stable; as 1 year after the experimental intervention had ended, these children were activating bilateral inferior frontal gyri and left superior temporal and occipito-temporal regions. This indicated the phonologic reading intervention had facilitated the development of those fast-paced neural systems that underlie skilled reading.

Similar conclusions concerning change in neurological processing in children were reached by Maurer et al. [83], who investigated the development of coarse neural tuning for print by studying children longitudinally before and after learning to read, and compared these patterns to those exhibited by adults who were skilled readers. Maurer et al. reported that coarse neural tuning for print peaked when children learned to read. Coarse N1 tuning, which

had been absent in non-reading kindergarten children, emerged less than 2 years later after the children had mastered basic reading skills in second grade. The coarse N1 tuning had become larger for words than symbol strings in every child. Coarse N1 tuning was also stronger for faster readers. On this evidence, Maurer et al. concluded that fast brain processes specialise rapidly for print when children learn to read, and play an important functional role in the fluency of early reading.

3.3. Neural connectivity is associated with fluent reading

Shankweiler et al. [84] also concluded that cortical integration of speech and print in sentence processing varies with reader skill. These researchers used functional magnetic resonance imaging (fMRI) to investigate the association between literacy skills in young adults and the distribution of cerebral activity during comprehension of sentences in spoken and printed form. The results from different analyses all pointed to the conclusion that neural integration of sentence processing across speech and print varies positively with the reader's skill. Further, Shankweiler et al. identified the inferior frontal region as the principal site of speech–print integration and a major focus of reading comprehension differences.

Additional studies used advances in fMRI to identify a relationship between white matter structure (as an indicator of myelination) and reading ability (e.g. [85, 86]). This area of the neurolinguistic literature was based on the premise that myelination was not only an index of the maturity of the insulation of individual fibres in the brain but was also an index of efficiency in neurological transmission [87, 88].

Hasan et al. [89] used diffusion tensor imaging to study the structure and distribution of white matter within the corpus callosum areas connecting the two hemispheres of the brain in children with dyslexia and those of typically developing readers of comparable age and gender. Hasan et al. reported that the posterior corpus callosum area was enlarged in children with dyslexia relative to the same area as measured in typically developing children. In addition, there were microstructural differences (e.g. the mean diffusivity of the posterior middle sector of the corpus callosum), which correlated significantly with measures of word reading and reading comprehension. Reading group differences between dyslexic and typically developing children were also found when using fractional anisotropy, mean diffusivity and radial diffusivity to measure the microstructural characteristics of the posterior corpus callosum.

Vandermosten et al. [90] also used diffusion tensor imaging tractography to examine the integrity of the three-dimensional white matter tracts connecting the left temporo-parietal region and the left inferior frontal gyrus, for which atypical functional activation and lower fractional anisotropy values have been reported in dyslexic readers. Their study revealed structural anomalies in the left arcuate fasciculus in adults with dyslexia. In addition, Vandermosten et al. were able to demonstrate a correlational double dissociation, which suggested that the dual route reading model has neuroanatomical correlates. In the sample studied, the left arcuate fasciculus seemed to sustain the dorsal phonological route underlying grapheme–phoneme decoding in reading, while the left inferior fronto-occipital fasciculus seemed to sustain the ventral orthographic route underlying reading by direct word access.

3.4. Repetition of phoneme-grapheme relationships is likely to build neural connectivity

Later in this chapter, there is reference to the longitudinal work I conducted in the 1990s with a dyslexic child called Q. There were indications from the neurologist's reports that Q's dyslexia was linked to a disorder of neural network connections, as well as a function associated with possible cortical immaturity (Dr Graeme Maxwell, personal communication). The research evidence reviewed in the previous sections was not available at this time, and it was only at the end of the 1990s that neurolingustic evidence began to emerge that many dyslexic children process reading material at a central level in ways different to normally developing readers [91, 92, 93].

Subsequent evidence suggested that the neural connections formed through the reading process involved a number of cortical areas [94], while also indicating a developmental trajectory by which exposure to written language engages areas originally shaped by speech on the path toward successful literacy acquisition [95, 96]. Equally important was the evidence from studies reviewed in the previous section (e.g. [97, 98, 99]), which suggested that connectivity in the brain could be enhanced through involvement in the process of learning to read, and that phonologically and phonemically based instruction could be particularly helpful in this process.

What my own clinical observations and the literature implied was that in Q's development as well as in the development of other dyslexic children, neural connections would not initially be strongly developed. Changes in connectivity as well as in white matter structure would also be likely to accompany phonologically based reading acquisition.

On a programmatic level, this implied that repeated reading of phonically based material would be likely to develop connections between the variety of cortical areas involved in fluent reading. Conversely, where repeated reading of phonically based material leads to observable changes in reading fluency, this would probably also point to increased functionality in the neural connections which underpin central processing of printed material.

In short, there was a two-way association involved. This suggested that in children with reading difficulties, increased time on task in reading tasks involving repetition of phoneme–grapheme relationships would be likely to build greater reading ability, as well as greater neural connectivity. This has informed the development of the 'Jud the Rat' reading materials described later in this chapter.

3.5. Limitations in correlational research

While the research reviewed in this section implies two-way associations between phonological- and language-based factors, reading ability, instruction in reading and brain connectivity, it is important to note that there are a number of limitations in correlational research.

As Scarborough [100] has suggested, two-way associations in the literature on reading may not be linear ones, for the reason that the development of reading is a multi-faceted process. In addition, Scarborough has suggested that there are many inconsistencies within the evidence on the relationship between phonological and language factors and reading disabil-

ities, which may indicate that there is a second causal chain (e.g. a persisting underlying condition which may account for all the two-way associations observed).

Studies by Galaburda [101], Poldrack [102] and Stein [103] have also suggested the high likelihood that some other mechanism (e.g. of magnocellular, auto-immune system or genetic origin) may account for the anatomical differences between the brain structures of dyslexics and normal readers. Underlying attentional or working memory factors (what Ahissar et al. [104, 105], have called an

anchoring-deficit) may also account for the evidence that only 5–10% of children who are fluent readers in the early grades at school stumble later, while between 65% and 75% of children designated as reading disabled early continue to read poorly throughout their school careers (and beyond), despite evidence that these readers have learned to read [106]. Anchoring deficit factors could also account for periods of 'illusory recovery', in which symptoms of reading disability appear to be remediated, but then reappear at later stages in schooling, suggesting that language skills may develop in a non-linear fashion [107].

In short, while the evidence of the associations between phonological and language factors and reading disability would appear to be compelling, other underlying factors besides a core phonological deficit may contribute to reading disability [108, 109, 110]. A number of other theories (e.g. those relating to how print material is processed visually) are thus reviewed in the following section. These theories have provided the rationale behind the use of large print in the 'Jud the Rat' materials, as well as the use of visual attentional cueing in the process of implementing the materials.

4. Literature relevant to the visual and visual-attentional sides of 'The Tales of Jud the Rat' reading fluency programme

4.1. Rapid visual and auditory processing as predictors of reading difficulty

A number of studies have indicated that developmental dyslexics do poorly in tests requiring rapid visual and auditory processing. Witton et al. [111] reported that neuronal mechanisms that were specialised for detecting stimulus timing and change were dysfunctional in many dyslexic individuals. The dissociation observed in the performance of dyslexic individuals on different auditory tasks also suggested a sub-modality division in the auditory system similar to that already described in the visual system.

Both Farmer and Klein [112] and Stein and Walsh [113] reported that dyslexia was associated with difficulties with moving visual stimuli. Hari and Renvall [114] also reported that dyslexic subjects often suffered from impaired processing of rapid stimulus sequences and suggest that sluggish attentional shifting can account for the impaired processing of rapid stimulus sequences in dyslexia. Amitay et al. [115] concluded that disabled readers suffered from both visual and auditory impairments, showing impaired performance in both visual and auditory tasks requiring fine frequency discriminations.

Talcott et al. [116] reported that both visual motion sensitivity and auditory sensitivity to frequency differences were robust predictors of children's literacy skills and their orthographic and phonological skills. Cohen-Mimran and Sapir [117] reported auditory temporal processing deficits in children with reading disabilities, and that children with reading difficulties had difficulty in discriminating between pure tones with short, but not long, interstimulus intervals, whereas controls performed well with both short and long interstimulus intervals.

Rapid auditory processing deficits have also been found to be consistent predictors of later reading achievement [118]. Lervåg and Hulme [119] reported that rapid automatised naming (RAN) measured with non-alphabetic stimuli before reading instruction had begun was a predictor of later growth in reading fluency, and continued to exert an influence on the development of reading fluency over the next 2 years after reading instruction had begun. Equally important were indications that there was no evidence of reciprocal influence of reading fluency on the growth of RAN skill. This would suggest that RAN is a function which taps the integrity of the left-hemisphere object-recognition and naming circuits which form critical components of the child's developing visual word-recognition system.

4.2. The influence of instruction on rapid processing ability

The literature, however, also indicates that rapid processing dysfunctions are responsive to training. Temple et al. [120] reported disruption of the neural response to rapid acoustic stimuli in dyslexia, with normal readers showing left prefrontal activity in response to rapidly changing, relative to slowly changing, non-linguistic acoustic stimuli. Dyslexic readers, in contrast, showed no differential left frontal response. Temple et al. also reported that dyslexic readers who participated in a remediation program showed increased activity in left prefrontal cortex after training.

Temple et al.'s results would suggest that the left prefrontal regions are normally sensitive to rapid relative to slow acoustic stimulation, but are insensitive in the case of dyslexic readers. Equally important are the indications that the left prefrontal cortex would appear to be plastic enough in adulthood to develop such differential sensitivity after intensive training.

Gaab et al. [121] reported that children with dyslexia had a fundamental deficit in processing rapid acoustic stimuli, but that this was responsive to training. While typical-reading children showed activation for rapid compared to slow transitions in left prefrontal cortex, children with developmental dyslexia did not show differential response in these regions to rapid and slow transitions in acoustic stimuli. After 8 weeks of remediation which provided training in rapid auditory processing, phonological processing and language skills, Gaab et al. reported that the children with developmental dyslexia showed significant improvements in both language and reading skills. They also showed activation for rapid relative to slow transitions in the left prefrontal cortex after training. Gaab et al. thus concluded that neural correlates of rapid auditory processing were disrupted in children with developmental dyslexia, but could be ameliorated with training.

These findings suggested that many children with reading difficulties have difficulties with rapid visual processing, difficulties with rapid auditory processing, as well as impairments of

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perceptual processing of rapidly changing acoustic stimuli. These findings also suggest that reading disabilities are often accompanied by impaired perceptual skills as well as specific perceptual deficits and perceptual difficulties which have neurological correlates. As with other areas of functioning, the relationship between behaviour and underlying neural connectivity would appear to be a two -way association, in which improved perceptual processing leads to improved neural connectivity, and vice versa.

4.3. The magnocellular theory of dyslexia

Overall, the research reviewed in the previous section would suggest that many children with dyslexia or poor reading ability have difficulties in processing rapidly changing signals, both auditorally as well as visually [122]. Visual processing difficulties, as well as auditory processing difficulties, have neurological correlates, suggesting the possibility of a general underlying attentional or processing difficulty affecting the development of reading ability.

The magnocellular theory of dyslexia [123, 124] suggests that underlying difficulties in auditory and visual processing can be traced to difficulties in the magnocellular component of the visual system. As Stein and Walsh comment:

'Developmental dyslexics often complain that small letters appear to blur and move around when they are trying to read. Anatomical, electrophysiological, psychophysical and brain-imaging studies have all contributed to elucidating the functional organization of these and other visual confusions. They emerge not from damage to a single visual relay but from abnormalities of the magnocellular component of the visual system, which is specialized for processing fast temporal information. The m-stream culminates in the posterior parietal cortex, which plays an important role in guiding visual attention. The evidence is consistent with an increasingly sophisticated account of dyslexia that does not single out either phonological, or visual or motor deficits. Rather, temporal processing in all three systems seems to be impaired. Dyslexics may be unable to process fast incoming sensory information adequately in any domain.' [125]

Stein and Walsh's conclusions have been supported by a number of studies. Salmelin et al. [126] used magnetoencephalography to identify impaired word processing in the occipito-temporal areas of dyslexics, while Livingstone et al. [127] reported that dyslexic subjects exhibited diminished visually evoked potentials to rapid, low contrast stimuli, but normal responses to slow or high contrast stimuli. Livingstone et al. suggested that the abnormalities in the dyslexic subjects' responses to evoked potentials were associated with a defect in the magnocellular pathway at the level of visual area 1 or earlier.

Livingstone et al. also compared the lateral geniculate nuclei from five dyslexic brains to five control brains, reporting abnormalities in the magnocellular, but not the parvocellular, layers in the dyslexic brains studied. As previous studies using auditory and somatosensory tests had shown that dyslexics perform poorly on tasks requiring rapid discriminations, Livingstone et al. hypothesised that many cortical systems can be divided into a fast and a slow subdivision; and further that that dyslexia is associated with difficulties in rapid processing within these fast subdivisions.

Similarly, Vidyasagar and Pammer [128] reported that impaired visual search in dyslexia relates to the role of the magnocellular pathway in attention, leading Vidyasagar [129] to suggest that attentional gating in primary visual cortex provides a physiological basis for dyslexia. Sireteanu et al. [130] also investigated the performance of children with developmental dyslexia on a number of visual tasks requiring selective visual attention and found that dyslexic children did not show the overestimation of the left visual field (pseudoneglect) characteristic of normal adult vision. Dyslexic children also showed shorter reaction times and a dramatically increased number of errors on these tasks, suggesting that children with developmental dyslexia have selective deficits in visual attention.

Misra et al. [131], for example, have identified a number of neurological correlates of rapid processing deficits, reporting that the majority of children and adults with reading disabilities also exhibit pronounced difficulties on naming-speed measures such as tests of rapid automatised naming, which required speeded naming of serially presented stimuli. In their study, functional magnetic resonance imaging was used to evaluate the neural substrates that were associated with performance on rapid naming tasks. Activation was found in neural areas associated with eye movement control and attention as well as in a network of cortical structures implicated in reading tasks, including the inferior frontal cortex, temporo-parietal areas and the ventral visual stream. Whereas the inferior frontal areas of the network were similarly activated for both letters and objects, activation in the posterior areas varied by task. These results suggested that rapid naming tasks recruited a network of neural structures which were also involved in more complex reading tasks, and suggested that rapid naming of letters pinpointed key components of this reading network.

4.4. Prevalence of magnocellular deficits: Evidence from multiple case studies

Vidyasagar and Pammer [132] have proposed that dyslexia is a deficit in visuo-spatial attention, not in phonological processing. However, the evidence from multiple case studies of disabled readers suggests that dyslexics may suffer from visual and auditory impairments but only a few suffer from a specific magnocellular deficit.

Amitay et al. [133], for example, reported that only six out of the thirty reading disabled subjects in their study had impaired magnocellular function, and that the performance of the other twenty four reading disabled subjects on magnocellular tasks did not differ from that of controls. Amitay et al. also reported that many of the reading disabled children showed impaired performance in both visual and auditory non-magnocellular tasks which required fine frequency discriminations. Overall, Amitay et al. concluded that some reading disabled subjects have generally impaired perceptual skills, while many reading disabled subjects have more specific perceptual deficits. The 'magnocellular' level of description, however, did not capture the nature of the perceptual difficulties in any of the reading disabled individuals in the sample, as the six subjects with impaired magnocellular function were also consistently impaired on a broad range of other perceptual tasks.

Similarly, Ramus et al. [134] analysed sixteen dyslexic subjects and reported that all sixteen dyslexics suffered from a phonological deficit. Ten of the subjects could be characterised as suffering from an auditory deficit, four from a motor deficit and two from a visual magnocel-

lular deficit. The results thus indicated that a phonological deficit can appear in the absence of any other sensory or motor disorder. A phonological deficit is also sufficient to cause a literacy impairment, as demonstrated by five of the dyslexics. Auditory disorders, when present, aggravated a phonological deficit, contributing to the literacy impairment.

These data thus indicated that auditory deficits could not be characterised simply as rapid auditory processing problems, as would be predicted by the magnocellular theory. Nor were they restricted to speech. Contrary to the cerebellar theory, Ramus et al. also found little support for the notion that motor impairments had a cerebellar origin or reflected an automaticity deficit. Overall, Ramus et al. concluded that the phonological theory of dyslexia could account for all sixteen of the subjects in their sample. There were also additional sensory and motor disorders in certain individuals.

Ziegler et al. [135] reported that children with dyslexia had significant deficits for letter and digit strings, but not for symbol strings. Visual-attentional theories of dyslexia could not explain these findings, as visual attentional theories postulated identical deficits for letters, digits and symbols in dyslexics. Ziegler et al. also reported that dyslexics showed normal W-shaped serial position functions for letter and digit strings. This finding suggested that their deficit could not be attributed to an abnormally small attentional window. In addition, the data indicated that the size of the deficit was identical for letters and digits, suggesting that poor letter perception in dyslexic children was not just a consequence of lack of reading.

What could account for Ziegler et al.'s data was that the process of mapping symbols onto phonological codes was impaired, as this was the case for both letters and digits. In contrast, symbols that did not map onto phonological codes were not impaired. This dissociation suggested that impaired symbol-sound mapping rather than impaired visual-attentional processing was the key to understanding dyslexia.

4.5. Both visual and visual attentional factors need to be taken into account in teaching reading

Despite convergent evidence that dyslexia is a language disability which has its foundations in difficulties in phonological and phonemic processing, both Schulte-Körne and Bruder's [136] review and Stein's more recent [137] review of current literature suggest that rapid processing, attentional and magnocellular factors are important influences on reading ability which should not be overlooked. Research from both Australia [138] and from Italy [139] also indicate that it is important to take account of visual attentional factors in remediating language-based learning difficulties.

In addition, visual features stemming from layout of reading material have been found to influence reading as well as comprehension outcomes [140]. Spinelli et al. [141] have suggested that dyslexic readers are affected by crowding of multiple characters and large numbers of words onto printed pages. Visual features of text such as print size [142], visual span [143], spacing of letters [144], spacing between letters [145, 146], as well as font size and spacing between words relative to print size and visual acuity limits [147] are also important to consider when publishing materials for poor readers.

The above research has implications for the development of reading materials for dyslexic children. As I had found in working with Q, research post 2000 indicated that dyslexic children would be likely to respond best to reading material which took account of factors such as length of words [148, 149], amount of text in paragraphs [150] and amount of text on pages [151].

How I have taken account of phonological and phonemic factors, as well as crowding, visual and visual-attentional factors, in writing the 'Tales of Jud the Rat' series as well as in developing the procedures used in the implementation of the materials is covered in the rest of this chapter.

5. The first stage of development of the 'Tales of Jud the Rat' programme: Extended case study

5.1. The need for graded reading materials of gradually increasing difficulty

Janet Lerner [152, 153, 154] has suggested that the methods used for children with learning difficulties can be used with all children. The reason for this is that all children respond to good teaching. Shaywitz et al. [155] also emphasise continuities across normal and dyslexic readers, interpreting dyslexia as occurring at the lower end of a normal distribution of reading abilities. While a diagnosis of dyslexia often has a high degree of stability over time, there are also a large number of children who are diagnosed as dyslexic in early grades who no longer meet dyslexic criteria in later grades at school. Thus the distinction between developmental dyslexics and other poor readers may be of limited usefulness.

Similarly, Elliott and Grigorenko [156] argue that the evidence suggests that both dyslexics and other poor readers benefit from structured phonological treatment. This implies that if a method is workable for a child who has severe reading difficulties, it is also likely to work for a child who has less severe learning difficulties, or for a child who has no difficulties at all.

This has been the principle guiding the development of the materials used in the reading fluency programme. These have been developed in two stages, working with children involved my practice in Johannesburg.

The first stage in the development of the reading fluency programme was based on the need for graded reading materials of gradually increasing difficulty for a child who was severely dyslexic (Child Q). These needed to be implemented at a distance of 6,000 miles from my rooms.

5.2. Implementation side-by-side with a method for teaching structured phonics which was both visual and verbal

Child Q worked with me over a number of years. She and her parents were South African but lived in Europe. The referral came internationally, and I was then consulted by the child's mother, who indicated that her child (called Q for the purpose of case study) had severe learning problems. These were intractable.

Q had been assessed as having developmental learning problems in Britain from age 5. This had been followed by a number of language and remedial interventions, which had been

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effective in developing skills, but not effective in increasing reading ability. When Q first came to see me at the age of 8, she did not know all her letters. It was also evident that she had both language and reading difficulties. Despite major phonological and expressive language difficulties, Q was of high intelligence, and had well-developed visual imagery and visualisation abilities.

As available instruction was not working effectively, Q's mother spent 2 h in Q's school daily, working individually with her child on a programme sent to her first by fax, and then by email. The initial programme I provided focused on phonically based instruction using synthetic phonics material. In addition, as the five vowel system previously used with Q had not been effective and as Q's strengths lay in visualisation, I utilised a system for teaching structured phonics to develop both word attack and spelling ability. This was both visual and verbal, based on a seven vowel system and colour coding.

Initially, developmental reading materials were provided by the teachers at Q's primary school, while the material provided by myself was designed to support the word analysis, spelling and sequential writing sides of Q's instructional programme. I also sent Q's mother material to teach number concept and arithmetic, with which Q had major difficulties.

Over the first year Q's progress was steady, but as her programme entered its second year, it became clear that there was insufficient graded reading material available in the school to support the gradual increase in the level of reading instruction which Q needed. Additional reading schemes were bought by the school; but as the second year progressed, we simply ran out of reading books which were available at the school and at her level. There was no alternative other than to develop reading material specifically designed to support the gradual increase in the level of phonic skills Q needed, as well as the amount of reinforcement of phonic skills required in her reading programme.

5.3. The Doctor Skunk stories

As Q was a South African child living abroad, the first two reading books I wrote were stories written about South African wild animals. However, I struck an immediate problem on a phonic level. South African wild animals have names like 'giraffe', 'elephant', 'eland', 'gemsbok', 'lion', 'leopard' and 'cheetah'. How would I be able to reconcile these indigenous names with Q's phonological and phonic needs?

To determine Q's phonic needs, I was using both standardised tests as well as a self-developed clinical test called the phonic inventories [157, 158, 159, 160], which classroom-based research [161, 162, 163, 164, 165, 166, 167, 168, 169] had identified as both valid and reliable, as well as predictive of learning difficulties at both junior and high school levels [170, 171, 172, 173]. Used clinically, the information yielded by the instrument was diagnostic and indicated that Q needed phonic materials targetting word endings such as 'ss', 'ff', 'll', 'ck', 'ng', 'tch' and 'dge', as well as vowel digraphs such as 'ai', 'ee', 'ea', 'oa', 'ay' and 'ou'.

In the first two reading books I wrote, it was impossible to reconcile the names of South African animals with these phonic needs. The word 'lion', for example, was spelled in a completely opposite way to the diphthong 'oi', which was one of the vowel digraphs which Q had not yet

established. 'Cheetah' included the 'ee' vowel digraph, and also included a schwa sound made by an 'a' followed by a silent 'h' at the end of the word. 'Buck' had a short vowel and a 'ck' ending. Tiger also met long vowel phonic criteria, but unfortunately tigers are not found on the South African veld.

I thus abandoned the aim of indigenising Q's reading material. As Q lived near a park, I focused instead on creating a more universal reading world of a small village set next to a park. In the village lived a number of phonically regular short vowel animals such as 'rat', 'cat', 'dog' and 'skunk'. The books were set in large print to increase the visual cues from the letters and words, and the paragraphs were kept short to enable Q to focus on the words she was reading by avoiding clutter. As the stories progressed, the short vowel animals interacted with long vowel animals such as 'mole', 'bird' and 'owl' and more complex polysyllabic but phonically regular animals such as 'rabbit', 'weasel', 'hamster', 'hedgehog' and 'badger'.

The main characters in the stories became the phonically regular short vowel 'Jud the Rat' and 'Jill the Dog', who first interacted with other short vowel characters such as 'Tom the Cat' and 'Doctor Skunk', and later with long vowel characters such as 'Max the Mole' and 'Mrs Weasel', and then with polysyllabic characters such as 'Len Hamster', 'Mr and Mrs Rabbit' and 'Bill the Hedgehog'. As the stories progressed, the characters met others who lived at a distance from the village such as 'Mrs Horse', 'Captain Ferret' and 'Colonel Tortoise'.

At basic levels in the stories there was a 'shop' and each character had a 'house' in the village. There was also a 'farm' close by where there were 'cows' which provided 'milk' and 'hens' which provided 'eggs', while further away from the village and at higher levels in the stories there were more phonically complex 'mountains', 'a valley', 'a country club' and even 'Benjamin Horse's Stud Farm'.

At basic levels in the stories, the animals entertained themselves by having 'fun' and at intermediate levels by having 'tea and cake' and 'a picnic', while at higher levels the animals met with 'brothers' and 'sisters' and 'in-laws' and 'cousins'. One of the 'uncles' drove a 'shiny red motorbike with a bright green sidecar', while other animals rode 'from up the valley' on the 'bus from town' driven by 'Sid the Badger'.

At higher levels in the stories there was 'a party' in 'Farmer Jim's barn' with music provided by 'Harry Hopper and the Doodlebugs', who accompanied 'Cheryl Crow' and 'The Mice Girls'. Harry Hopper's band played polysyllabic 'guitars' and 'saxophones' and 'trumpets' through 'amplifiers'. More traditional music was also provided at the party on phonically counter-intuitive 'violins' by 'The Veteran Insects String Band', until Doctor Skunk came along and performed as the phonically intuitive 'Screaming Lord Skunk' and then wrecked the proceedings.

It will be gathered from the above that the Doctor Skunk stories were based on structured phonic principles which gradually increased in level, and were designed to teach as well as to entertain. For in the absence of other appropriately graded reading materials, it was important to keep Q interested, with material which appealed to her well-developed visual imagery and her delightful sense of humour, while at the same time addressing the basic progression in phonic complexity which Q needed to learn to read fluently.

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5.4. What were the effects of this type of reading instruction?

In her longitudinal case study of the effects of instruction on Q's phonic, reading and spelling development, Sfetsios (2002) [174] described the development of the reading materials used in Q's programme as follows:

'Simultaneously with the introduction of rule-based instruction through the spelling, dictation and written side of the programme, an attempt was made to sequence the skills introduced in the reading side of the programme, in order for the written and reading sides of the programme to reinforce one another.

It was evident that Q needed a gradual progression when reading, and found changes in language register confusing (Professor Potter, personal communication, 2002). What had been established through the written side of the programme was that constant reinforcement was necessary before Q was able to use a particular phonic rule in reading, or orthographic rule as this applied in writing and spelling. Difficulties were pronounced where this involved a combination of vowels or chunking of letters. The Phonic Inventories (see Appendix A) indicated that she had particular difficulty with the consonant clusters commonly used in word endings, and the decision was made to target these and focus on the rules involving combinations of consonants used at the ends of words after short vowels. This was the focus before any attempt was made to target the long vowel sounds represented in vowel digraphs and diphthongs.

The reading materials available in Q's school essentially moved too quickly to provide the basis for learning and overlearning necessary to reinforce the alphabetic rules introduced in the written side of the programme, and the type of consistent use of a gradually expanding core vocabulary necessary for Q to progress (Professor Potter, personal communication, 2002). The indication on the reading side was thus for a reading programme which reinforced the skills introduced in the written side of the programme, and which did not increase in complexity too quickly. Here we found that conventional reading schemes were not sufficient, either singly or in combination as a part of a broader reading scheme. The font size used in the books was also problematic, in that Q responded better to larger as opposed to smaller font sizes.

Against this background, the decision was taken to develop one story and a core set of characters and extend them in the beginning, creating a context and world of meaning with which Q could become familiar, and then extending these parameters to new and wider contexts. The story would need to work from the familiar, and introduce a graded and gradually extending vocabulary. Q was very interested in animals. She also lived in an area adjacent to parkland in Holland. These two aspects were therefore selected as contextual features of the story created. The Doctor Skunk stories (see Appendix R, pp.1xxxiv–1xxxvii) revolved around a group of animals who lived in a parkland, each animal representing human qualities to which Q could relate and enjoy. The story had a strong comical angle and ensured that Q maintained interest in the antics of the growing number of characters over the 6-year remedial period.

In practice, the Doctor Skunk stories provided the vehicle both for the development of reading as well as a springboard for the development of Q's imagery and imagination, and for her own descriptive and creative writing (see Appendix R, pp. xciii–xcv). It should be borne in mind that owing to her developmental difficulties, Q had lost out on many situations involving social interaction through play and involvement with other children as a contributing and functional partner in learning activities at school. The key to Q's learning to read was the fact that she was able to discover humour and enjoyment in the reading act, and to maintain her interest in reading while experiencing success in working with text, both in reading and writing (Professor Potter, personal communication, 2002).

Four years later at the time Q went to high school, she was still interested in the characters in the Doctor Skunk stories and their antics, and had covered 23 books involving several thousands of pages of text in large print. The gradually increasing difficulty of the orthography used in the text had taken her from the level of short vowels and three letter words to the ability to decode the work she was required to handle at school (see Appendix R, p.1xxxvii). By the time it was possible to reduce the font size on the printed page after 4 years of this type of work, she had also developed the skills required to read more widely, and for enjoyment.' [175]

The gains in reading, spelling and dictation made by Q over a four and a half year period are presented in Table 1 below

	July 1997 M's age: 10 years 2 months	**February 1998** M's age: 10 years 9 months	**June 1998** M's age: 11years 1 month	**June 2000** M's age: 12 years 11 months	**April 2001** M's age: 13 years 11 months	**August 2001** M's age: 14 years 3 months	**December 2001** M's age: 14 years 7 months
	Age	**Age**	**Age**	**Age**	**Age**	**Age**	**Age**
Oral Reading							
Rate	7.9	7.7	7.9	8.9	7.10	8.2	8.0
Comprehension	7.11	8.7	9.5	9.8	9.1	9.11	9.11
Silent Reading							
Rate	7.0	7.5	7.4	8.0	7.3	7.9	8.0
Comprehension	8.6	9.7	9.12	10.3	9.2	10.2	9.5
Listening	9.2	9.2	9.2	10.2	9.2	10.2	9.2
Flash Words	7.10	8.0	8.2	9.6	9.2	9.7	9.11
Word Analysis	8.0	8.3	8.2	9.11	9.5	9.11	9.11
Spelling (Durrell)	7.3	8.0	8.0	9.6	8.2	8.8	8.2
Handwriting	7.4	8.3	8.3	8.9	9.2	9.0	8.5
Spelling							
Schonell Form A	7.2	7.6	8.4	8.7	8.5	9.4	8.6
Schonell Graded Dictation							
Test A	-	-	7.6	8.1	-	-	-

Test B			*No score	8.0	8.0	9.6	8.0
Test C	-	-	-	7.6	8.5	10.0	7.0
Test D	-	-	-	-	-	-	6.1
Daniels and Diack							
Graded Reading Test	7.2	-	-	-	-	-	-
Standard Spelling Test	7.3	-	-	-	-	-	-
Visual Memory	7.9	7.0	8.5	8.8	8.8	8.8	8.8
Hearing Sounds in Words	8.6	7.11	9.0	-	-	-	-
Auditory Phonic Spelling	-	-	8.8	10.8	10.2	10.2	7.3

*There is no score as it was found that Q was not ready for this level of dictation

Table 1. Q's Progress as Measured by Durrell Analysis of Reading Difficulty Age Scores

From Table 1, it will be clear that Q made gains, despite weaknesses in the phonological, phonemic and language areas, and difficulties with rate of reading. Her strengths lay in visual imagery and visualisation, which were utilised in her reading programme, as well as in the methods used to teach her spelling and sequentialisation. However, despite a programme which focused on phonological and phonemic development combined with tailor-made reading, writing and spelling programmes, Q did not develop to be a fluent reader. Both rate of reading and rate of work continued to be particular problems. She was nevertheless able to cope mainstream schooling up to the end of junior high school, requiring scaffolding and support to do so. She then completed her final years of schooling in a remedial school.

Summarising Q's progress, Sfetsios commented,

'Gains made with Q in reading, spelling and dictation have been hard won. Success has been a result of much dedication and support of her mother and father, remedial therapists and tutors, however, above all, it is a credit to Q's motivation and persistence. Her continuing willingness to undertake a programme that has been built step-by-step and skill-by-skill has resulted in her moving from only being able to recognise 16 letters of the alphabet to successfully attending a mainstream British High School.' [176]

6. The second stage of development of 'The Tales of Jud the Rat' reading fluency programme

6.1. A set of graded phonic ebook materials for paired reading

It is very infrequently that I encounter children in my practice who have as intractable reading and spelling difficulties as those of Q. Early in 2013, however, I encountered another child (A) who was not making progress in reading, despite therapy directed at phonological and

phonemic development, combined with a programme of reading, writing and spelling support. It was evident that there were major difficulties in A's reading fluency, despite progress in the development of phonological and phonic skills, as well as word analysis and sentence reading abilities.

As with Q, the report from A's neurologist (Dr Graeme Maxwell, personal communication) [177] indicated that there were attentional difficulties combined with attentional lapses, stemming from cortical immaturity and a slow myelinisation process. On a functional level, it was evident that A was not making progress in reading despite the fact that his school was sending out a variety of graded reading books which were then read orally at home and in his remedial support sessions in the afternoons.

At this stage (mid 2013), I took the decision to relook at the Doctor Skunk stories, and to develop additional material in a format in which they could be used to support A's need to become a more fluent reader. This required writing more graded material based on phonic associations which were introduced and then repeated. This set of ebooks ('The Tales of Jud the Rat') would then be sent to A's parents by email and implemented via a form of paired reading aimed at using repeated reading to develop automaticity and reading fluency.

I first tried out the material with A in my sessions with him. Once it was evident after 6 months of instruction that this type of programme was producing effects, the material was then made available for wider use; at the beginning of 2014, I suggested to the parents of seven other children in the practice who were not fluent readers that they should also use the programme. In this way, an initial cohort of children started working with the reading fluency materials.

This consisted of three children (A, B and C) of junior primary school level, three (D, E and F) were at upper primary school level and two children (G and H) who were at junior high school level. Each of these children had been diagnosed as being of average to upper intelligence with scatter in the IQ profile, and as having learning and reading difficulties. Each of these children was also being seen by the same neurologist, who had diagnosed attentional deficits and cortical immaturity linked to slow rate of myelination.

The ebook-based reading fluency programme followed by this initial cohort of children is described in the next section. This will be followed by discussion of the neurolinguistic research which has provided the theoretical basis of the programme materials and the oral impress method and visual tracking methods used in programme implementation. The assessment and evaluation process will then be described, followed by presentation of results. Implications will then be discussed at the end of the chapter.

6.2. An ebook series of gradually increasing level of difficulty

It was only near the end of the first stage in the development of the 'Doctor Skunk' stories that the books I had written began to be delivered as attachments to emails. During the second stage of development of the programme, email delivery was used with all children. One reason for this was that a large amount of additional graded material had been written over the second half of 2013, based on recent (post 2000) neurolinguistic literature. In addition as, there were now eight children of different ages and reading levels in the 2014 cohort, ebook delivery of

the second series materials ('The Tales of Jud the Rat') became an integral feature of the reading fluency programme.

An additional reason for ebook delivery is that many children's parents travel considerable distance to the rooms in Johannesburg where I run my practice. One family travels 500 kilometers weekly. A number of other parents in the practice live over a hundred kilometers away from my rooms, travelling long distances to see me. The reason that they do so is that there is a high level of demand for instruction as well as materials for children with reading difficulties, particularly from areas outside Johannesburg. This is probably a feature linked with deteriorating schools in the public sector in South Africa, as well as a dearth of appropriate scaffolding and support in the schools close to where many parents live.

All parents in my practice, however, have email, and for this reason, 'The Tales of Jud the Rat' reading fluency programme has been developed in a form in which it can be delivered by email and then downloaded and used by parents at home. As the reading fluency materials have been designed to complement the sessional work I do, parents are provided with tutorial support by email, as well as questions and answers by cellphone. As new books in the series are also sent out by me, I am able to monitor the rate at which the children are covering the material, and through this establish the amount of paired reading done using the programme at home.

My own sessions thus work side-by-side with the implementation of the reading fluency programme by parents. In this way, I can focus in my sessions on developing basic skills in phonological and phonic development, as well as the sequentialisation and working memory skills which underpin writing, spelling and learning at school. I am also able to do work to develop the abilities to use these basic skills in reading comprehension and school-related work.

The aim has been to provide a large body reading fluency materials which are appropriately graded, which are readily available and inexpensive, and which can be used daily at home. As the materials have been written to meet the needs of parents of children in my practice who have rate of work problems linked to reading fluency difficulties, through the materials parents have thus become partners in the learning process.

6.3. Use of phonic strategies in writing the materials

My experience in working with Q had informed the decision that the 'Doctor Skunk' stories should be written on phonemically based principles. Developments in the neurolinguistic literature post 2000 then ensured that this principle should be carried forward into "The Tales of Jud the Rat" series. Specifically, I ensured that all words used in the ebooks would be able to be decoded using phonically based strategies. In addition, words used would then be repeated.

This would be done so that 'The Tales of Jud the Rat' materials would be suitable to be used by teachers and therapists working in a phonologically based paradigm. They would also be suitable for use by parents to develop automaticity in sound–letter associations through

repeated reading. In addition, being phonically based, the materials could also be used for the purposes of teaching phonic analysis and spelling rules.

In short, my experience in working with Q suggested that repetition of phonic associations was necessary in developing fluent reading, and that there were side-by-side improvements in connectivity on a neural level (Dr Graeme Maxwell, Q's neurologist, personal communication) [178]. As this reciprocal link was also indicated in the neurolinguistic literature post 2000, there was clear support for the use of phonic strategies in writing 'The Tales of Jud the Rat' materials.

6.4. Use of repetition of phonic associations to build decoding ability

As with the 'Doctor Skunk' stories used with Q, the 'Tales of Jud the Rat' materials were designed to enable repetitions which were phonically based, and exposure to phonic rules which proceeded up in level very gradually. As there was a need for plenty of repetition, there was also a need for plenty of material.

The 'Doctor Skunk' stories had been implemented side-by-side with instruction in phonics, using a combination of the synthetic phonic principles embodied in the Orton/Gillingham [179] approach and the analytical phonics principles suggested by Sister Mary Caroline [180]. As the field had now moved on, 'The Tales of Jud the Rat' materials were designed to provide the degree of repetition necessary to reinforce remedial teaching done within both the Orton/Gillingham paradigm as well as teaching done within more modern phonologically based paradigms (e.g. [181]).

Underpinning both sets of materials was an assumption that repetition of phonic associations would lead to probable benefits at a neurological level. The 'Doctor Skunk' stories were based on the Wernicke-Geschwind hypothesis [182], the assumption being that a combination of amount of time on task and amount of repetition would enable associations to form within the occipito-temporal areas of the left hemisphere of the brain.

Given the more precise indications concerning neural connectivity which had emerged from neurolinguistic research post 2000, 'The Tales of Jud the Rat' materials assumed that neural connectivity would be improved by repetitive exposure to phonically graded material set in large print, specifically between the left occipital and parietal lobes in which large print would be processed, the temporal/occipital lobes in which sound–letter associations would be processed and also those areas of the left temporal and frontal lobes in which higher levels of language processing take place. Writing and spelling based on these associations would then be encoded in medial areas of the left side of the brain in both right-handed people as well as in the majority of left-handed people.

In short, stronger associations at a central level would be likely to lead to positive results, as a number of studies reviewed in this chapter had indicated that this would be likely to be the case.

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6.5. Use of material set in large print: Visual features of the ebooks

The literature post 2000 also indicated that there are visual features in text which may influence the way in which dyslexic children learn to read [183, 184]. 'The Tales of Jud the Rat' materials were thus also designed to take into account visual attentional as well as visual features of text.

A feature of ebooks and electronic print is that they can be set in different fonts and print sizes. The ebooks in 'The Tales of Jud the Rat' series were set in large print and made use of short sentences and paragraphs as well as large amounts of white space on the page. This was done so that the material could avoid crowding, as this was to likely to affect dyslexics on a visual level (e.g. [185, 186]).

Print size was one important variable. O'Brien, Mansfield and Legg [187] had reported constant reading rates across large print sizes in dyslexics, but that a sharp decline in reading rates occurs once print is presented below a critical print size, indicating that dyslexic readers would require larger critical print sizes to attain maximum reading speeds. O'Brien, Mansfield and Legg's results indicated that reading rate-by-print size curves followed the same two-limbed shape for dyslexic and non-dyslexic readers. The reading curves of dyslexic children, however, showed higher critical print sizes and shallower reading rate-by-print size slopes below the critical print size. Non-dyslexic reading curves also showed a decrease of critical print size with age. Statistical analysis indicated that a developmental lag model of dyslexic reading had not accounted for the results, since the regression of critical print size on maximum reading rate differed between the two groups.

Research reported by Brennan, Worrall and McKenna [188] indicated that a number of other aspects of the design and formatting of materials used in written communication (e.g. use of simplified vocabulary and syntax, large print and increased white space) can influence comprehension. Brennan, Worrall and McKenna worked with aphasic adults, and reported that adding pictures, particularly Clip Art pictures, may not significantly improve the reading comprehension of people with aphasia, but that simplified vocabulary and syntax, large print and increased white space were significant features to consider when using all written communication with people with aphasia.

Martelli et al. [189] suggested the value of using white space when presenting materials for dyslexic children learning to read, for the reason that crowding may influence reading speed. Levi [190] also pointed out that crowding was an important influence on visual discrimination and object recognition which has a relationship with dyslexia. Based on review of the literature, Levi suggested that there were two stages involved in the development of object recognition which can be localised to the cortex. The first stage involves the detection of simple features, while the second stage is required for the integration or interpretation of the features of an object. In addition, there is evidence that top–down effects (i.e. effects of interpretation and comprehension) mediate the bottom–up effects of crowding, while the role of attention in this process remains unclear.

Overall, Levi suggested that there is a strong effect of learning in shrinking the spatial extent of crowding, indicating that instruction ameliorates the influence of crowding on reading ability. Legge and Bigelow's review [191] also indicated that both size and shape of printed symbols determine the legibility of text, and for this reason, the PDFs of the ebooks in 'The

Tales of Jud the Rat' series were set in large print, using Arial, which is a simple uncluttered font.

6.6. Use of visual tracking to maintain visual attention in the implementation process

Stein's review [192] indicates that visual attentional factors are likely to influence reading ability. In addition, Sireteanu et al. [193] have suggested that children with developmental dyslexia show selective visual deficits in attention, with dyslexic children showing shorter reaction times as well as dramatically increased numbers of errors.

For this reason, the procedures used for implementing 'The Tales of Jud the Rat' materials have been designed to provide a combination of phonically based material and large print, as well as visual tracking. The assumption is that this combination would assist developing phonological and visual associations while also maintaining visual attention, and that this combination, in turn, would be helpful in building connectivity on a magnocellular level.

Visual tracking is thus built into the implementation process of 'The Tales of Jud the Rat' materials, with a pointer being used from the top of the line focus attention on words read, as well as attention on those visual features in words which provide maximum cues in the decoding process. Visual and visual attentional decoding processes are then combined with phonic repetition throughout the core series of ebooks. The reason for this is that research evidence suggests that rapid automatised naming (RAN) is a correlate of early reading skills and that RAN continues to exert an influence on the development of reading fluency over the next 2 years after reading instruction has started [194].

Given needs for longitudinal intervention where reading problems are major or intractable (such as in Q's case), the series of 'The Tales of Jud the Rat' ebooks has been designed to provide enough graded reading material for the programme to be used for at least 2 years and for up to 4 years with any child, should this be necessary. This means that the combination of use of large print, visual tracking and phonic repetition can be continued for an extended period, until an age appropriate level of reading fluency has been developed.

How this is done is described in the following sections.

7. Provision of material of gradually increasing complexity: The core and extension readers

7.1. The core large-print reading series

Carol Chomsky [195] has suggested that struggling readers decode slowly and with difficulty and that, despite their hard-won decoding skills, they are also passive to reading. Chomsky also suggests that what is needed is material which will engage attention, and also make large amounts of textual material available.

The core series of large print readers is designed to provide a large amount of material which can be used to develop reading fluency. There are currently 19 ebooks which are graded in terms of level. The titles of the ebooks in the core reading fluency programme can be found on

my website at http://www.charlespotter.org, while the programme as a whole is designed as follows:

Core Series: Title of book	Extension	Award
1. JUD THE RAT AND TOM THE CAT		
2. TOM THE CAT TRIES TO TRICK JUD THE RAT, BUT GETS VERY WET AND COLD		
3. TOM THE CAT TRIES TO BE CLEVER, BUT LANDS UP SICK IN BED	Supplementary Series One: The Stories of Sid the Badger – Basic Level Readers	Supplementary Series One: The Stories of Sid the Badger – Basic Level Readers
4. JILL THE DOG		
5. TOM THE CAT MAKES A MISTAKE, BUT LANDS UP BEING SUCCESSFUL		
6. HOW JUD THE RAT REALISES HE HAS BEEN TRICKED, AND TRIES TO SAVE FACE	Supplementary Series Two: The Stories of Bill the Hedgehog – Intermediate Level Readers	Certificate: Reading Fluency Level Two + Book Prize
7. JUD THE RAT'S HOUSE		
8. THE SMELLY END OF THE STREET		
9. TOM THE CAT CATCHES JUD THE RAT, BUT JUD STILL GETS AWAY	Supplementary Series Three: The Chronicles Doctor Skunk: Part One – Higher Level Readers	Certificate: Reading Fluency Level Three + Book Prize
10. JILL THE DOG'S SHOP		
11. TOM THE CAT'S SECRET		
12. JILL THE DOG SOLVES PART OF THE PUZZLE		
13. SID THE BADGER FINDS THE ANSWER		
14. TOM THE CAT'S TRAP	Supplementary Series Four: The Chronicles of Doctor Skunk Part Two – Higher Level Readers	Certificate: Reading Fluency Level Four + Book Prize
15. JUD THE RAT AND MAX THE MOLE		
16. DOCTOR SKUNK'S VISIT		
17. HOW DOCTOR SKUNK GOT BACK TO THE STREET AND THEN WENT HOME		
18. JUD THE RAT SPOILS TOM THE CAT'S BIKE RIDE		
19. TOM THE CAT GETS HIS OWN BACK	Supplementary Series Five: Stories of the Valley and Legends of the Deep Woods -- Extension Readers	Certificate: Reading Fluency Level Five + Book Prize

Table 2. Dr Charles Potter's reading fluency programme: design

Each of the elements in the programme is ebook-based, supported by email tutorials. The ebooks are also designed to be delivered by email. This provides the flexibility for the core programme of large print readers to be implemented both as a support programme for parents working with me on a sessional basis, or at distance.

7.2. Reducing font size and extending vocabulary: The extension readers

The evidence from the literature is convergent in indicating that reading difficulties are language based [196], though a combination of auditory and visual as well as attentional factors may also influence reading abilities [197], There is also evidence that increased reading fluency influences reading comprehension [198] and that conversely, top–down effects involved in language and reading comprehension mediate the influence of auditory, visual and attentional and fluency factors on reading ability [199].

For this reason, it will be evident from Table 2 above that reading fluency is conceptualised as a variable having stages. These stages can be determined both from reading behaviour as well as performance on reading tests measuring reading accuracy and reading rate.

As certain children may require substantial work before an age-appropriate level of reading fluency is developed, there are five supplementary series in the programme. Each of these supplementary series consists of between five and seven ebooks. At lower levels in the programme, there are extension stories based on rhythm and rhyme, as well as stories based on sequenced storytelling. At higher levels, there are extension stories drawn from the original 'Doctor Skunk' series written for Q, as well as extension stories designed to link with tales of imagination and legends. There are also procedures for use of the materials for building skills in analytical phonics, spelling and sequential spelling, as well as an awards programme for children completing a certain number of books and reaching particular levels of reading fluency. Despite having a large number of ebooks available, the aim is that the materials in the programme should be used only as long as is necessary to develop an age appropriate level of reading fluency. What this means is that decisions concerning the need for continued use of large print and repetition are evidence-driven and taken both quantitatively as well as qualitatively. In addition, as the evidence from the paired reading literature is not convergent concerning optimal levels of difficulty of reading material, the books in the core series are written based on predominantly short words which can be decoded using phonic rules. Books in the extension material also include more complex vocabulary.

Specifically, once there is evidence that reading fluency is developing from one stage to the next and evidence that age-appropriate top-down effects are operating (i.e. improvements in reading fluency as well as comprehension are taking place), children working through the 'The Tales of Jud the Rat' series are directed to supplementary and extension materials. In these ebooks both print size and repetition of words are reduced, At the same time, the amount of repetition in the paired reading procedures used for implementation of the reading fluency programme is also reduced.

7.3. Reading fluency as one element in a broader intervention

It will be apparent from the above that the 'Tales of Jud the Rat' programme can be used for purposes of clinical teaching as well as in other situations in which observation is used to determine needs for intervention. The assumption is that one size may not fit all, and that as Scarborough [200] suggests, the variables involved in reading acquisition may not be linear. In addition, multiple case studies suggest variation in the aetiology of adult dyslexics [201] as well as children [202].

What this means is that not all children need the same thing, and that not all dyslexic children are likely to respond to the same treatment. The reading fluency programme is thus conceptualised as one element in a broader intervention. Its value lies in its potential for providing sufficient time on task for automaticity in reading to be developed. At the same time, the results obtained also reflect the skill of the teacher or therapist in using the tools and the programmes available to him or her, and 'The Tales of Jud the Rat' series is only one of a number of possible tools and programmes.

What this also means is that for optimum results, paired reading using 'The Tales of Jud the Rat' programme should be combined with other programmes involving phonic teaching [203] as well as exposure to other texts in which vocabulary is broader and difficulty levels are higher [204]. As reading and spelling are linked processes, how this is done (i.e. how the programme is structured and how other additional instructional programmes are organised and implemented) is essentially based on assessment, evaluation and clinical judgement as interpretive processes, as described in the following sections.

7.4. Assessment and evaluation as informing clinical judgement

The ebooks in the reading fluency programme are not a panacea. They can best be described as an exercise programme designed to provide a structured and sequenced means for developing reading fluency as one element in a broader instructional programme. If the reading fluency programme is implemented by parents for 20 min a number of times a week, its potential value lies in enabling time on task in reading to be substantially increased, using graded materials which have been developed on a conceptual basis linked to recent developments in neurolinguistic research.

As it is important to establish the need for as well as the effects of the 'Tales of Jud the Rat' programme as well as the need for other interventions targeting the development of phonic analysis, reading comprehension, spelling and sequential writing ability, there are systems for assessment and evaluation linked to the materials. These are based on a process of action research [205], in which assessment is used to establish needs for intervention, followed by a process of planning and implementation in which evaluation is integral.

Placement in the programme is initially made on the basis of reading level. Based on the process of evaluation, awards are also made both for effort as well as improvement. These awards are linked to extension activities, in the form of ebooks which are at a higher level, as well as end books for broader reading.

Children are placed in the programme based on a system of assessment and evaluation involving quantitative indicators from four core reading, spelling and sequential spelling tests. Reading fluency and reading comprehension are also assessed via other reading tests, and supported by additional testing of phonemic knowledge and reading comprehension abilities. During implementation, these data are then linked to qualitative indicators of reading fluency based on parental reports. This is done by informal interviews as well as questionnaires.

The evaluation is thus multi-method [206, 207], based on both quantitative and qualitative evidence linked to other available data on school and classroom performance as well as reading habits. Once placement has been made at a particular level in the reading materials, the first ebook is sent out by email. This is supported by a written tutorial, and if possible a trial session in how to support the paired reading procedure with visual tracking, and how to pace repeated reading.

Once parents have tried out the materials, a formative evaluation questionnaire is completed. Only at this stage is the child brought into the programme. As the sequence of the core reading series is published on the author's website, the child's progress through the core reading materials can be tracked both by parents and their teachers or therapists. Summative evaluation is then completed after a number of books have been worked through, as the basis for achieving awards, as well as entry into the intermediate- and higher-level series.

This decision is based on clinical judgement and can be made at any level in the programme, but generally occurs once the child has reached reading fluency level three. Parents are involved in this process, as well as in the system of awards and the summative evaluation process conducted at the end of each calendar year, which involves post-testing.

8. Results

Though 'The Tales of Jud the Rat' reading programme has been developed on a clear theoretical rationale, in the final analysis any reading programme is merely a tool which is as good as the user. I have learned a great deal from working with parents as well as other therapists and teachers as part of the formative and summative evaluation process. This has shaped not only the sequence of the programme but also the awards system and the use of supporting and extension reading materials which now form an integral part of the structure of the programme.

Overall, the results have been very promising. Based on use of the materials for a period of 6 months as part of a broader-based remedial intervention, the results of the first cohort of children are presented in Table 3 below.

It will be evident from the above that all children in the initial cohort placed on the programme have made good progress, as indicated by gains in reading age after 6 months programme usage. Evaluative comments made by both parents and children have also been very positive. These can be summarised in Table 4 as follows.

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Perhaps, the most important qualitative indicator, however, is that all parents who were using the materials at the end of 2014 have asked to continue using them this year (2015). Equally important is the evidence that many of the children using the programme have reported improvements in rate of work at school. Based on these positive indicators, an increasing number of children are currently working with the materials, some working with their parents as part of their weekly contact with me, and some working with their parents or with teachers or other therapists at distance from my rooms.

Children in Reading Fluency Programme	**Grade Level at School**	**Schonell One Word Reading Test**	**Holborn Sentence Reading Test**	**Schonell Single Word Spelling Test**	**Schonell Dictation Tests**
Child A *Pretest*	*start Grade 2*	*6 years 9 months*	*6 years 9 months*	*6 years 6 months*	-
Child A Post-test	end Grade 2	7 years 7 months	8 years 3 months	7 years 5 months	< 6 years 0 months
Child *B Pretest*	*start Grade 3*	*7 years 7 months*	*8 years 6 months*	*7 years 8 months*	*6 years 0 months*
Child B Post-test	end Grade 3	8 years 8 months	9 years 2 months	8 years 7 months	9 years 0 months
Child C *Pretest*	*start Grade 3*	*7 years 0 months*	*7 years 7 months*	*7 years 5 months*	*< 6 years 0 months*
Child C Post-test	end Grade 3	8 years 11 months	8 years 6 months	9 years 0 months	7 years 6 months
Child D *Pretest*	*start Grade 5*	*7 years 7 months*	*8 years 6 months*	*7 years 4 months*	*7 years 5 months*
Child D Post-test	end Grade 5	9 years 0 months	9 years 2 months	9 years 1 month	8 years 6 months
Child E *Pretest*	*start Grade 5*	*7 years 7 months*	*8 years 0 months*	*8 years 1 month*	*< 6 years 0 months*
Child E Post-test	end Grade 5	9 years 2 months	8 years 11 months	8 years 7 months	8 years 8 months
Child F *Pretest*	*start Grade 7*	*8 years 2 months*	*8 years 6 months*	*6 years 8 months*	*6 years 9 months*
Child F Post-test	end Grade 7	10 years 7 months	9 years 10 months	8 years 8 months	7 years 9 months
Child G *Pretest*	*start Grade 8*	*8 years 11 months*	*9 years 2 months*	*8 years 6 months*	*8 years 9 months*
Child G Post-test	end Grade 8	11 years 3 months	9 years 10 months	9 years 6 months	8 years 9 months
Child H *Pretest*	*start Grade 8*	*10 years 6 months*	*9 years 2 months*	*9 years 11 months*	*10 years 7 months*
Child H Post-test	end Grade 8	"/> 12 years 6 months	13 years 5 months	10 years 11 months	12 years 0 months

Table 3. Progress of 2014 Cohort as Measured by Reading, Spelling and Dictation Age Scores

Children in Reading Fluency Programme	Improvement in Reading Accuracy	Improvement in Reading Rate	Improvement in Reading Hesitancy and Confidence	Improvement in Ability to Read New Material	Improvement in Reading Comprehension
Child A	*	*	*	*	*
Child B	*	*	*	*	*
Child C	*	*	*	*	*
Child D	*	*	*	*	*
Child E	*	*	*	*	*
Child F	*	*	*	*	*
Child G	*	*	*	*	*
Child H	*	*	*	*	*

Table 4. Summary of Qualitative Evaluations by Parents: 2014 Cohort

Overall, the experience has been a very positive one. While the results we have are preliminary, the evidence so far would also suggest that parents can use the programme with their children and that schools, teachers and therapists can also use the materials to support the work they are doing. The evidence also suggests that those children who proceed through the programme at the rate of one ebook a month make substantial progress.

9. Summary and evaluation

This chapter has presented eight major assets of 'The Tales of Jud the Rat' series.

a. The material has been developed based on clinical teaching as well as neurolinguistic theory.

b. The material is graded, based on structured phonic principles.

c. The material is set in large print to increase visual cues as well as reduce crowding.

d. There is plenty of material available, and there is enough for the core reading materials to be used for as long as is necessary to develop reading fluency, even with readers who require a 2-year intervention (or more) as their reading problems are severe or intractible,

e. The material is available in electronic ebook form. This implies that all material can be sent out by email and used at a distance. All core tests and evaluation procedures can also be applied at a distance.

f. There are established procedures for implementation, which include visual tracking.

g. Once downloaded, 'The Tales of Jud the Rat' material is implemented using repeated paired reading to develop automaticity in reading.

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h. The implementation and evaluation procedures are simple, and can be used by parents and peer tutors, as well as by teachers and therapists.

While the research evidence reviewed in this chapter would suggest that automaticity forms the foundation for both increases in reading rate and accuracy as well being associated with improvement in reading comprehension, there are a number of disadvantages of the programme.

- The material targets reading fluency and does not overtly target reading comprehension.
- While the literature suggests that the development of automaticity is an essential skill and the evidence from parent use of 'The Tales of Jud the Rat' material suggests that the children who have used the programme have improved in a number of different aspects associated with fluent reading, the results we have so far are not definitive.
- The 'Tales of Jud the Rat' programme has so far only been used under clinical settings, and my own clinical experience suggests that the results of any one programme will only be as good as the other aspects of instruction which accompany it. Put another way, any educational programme is merely a tool. It will produce best effects where the programme implementer is skilled, and in situations where the programme is used in conjunction with other instructional programmes which also target improvement.

Despite these potential weaknesses, we have had good results with 'The Tales of Jud the Rat' series, and there are probably a number of reasons why this is so. The first reason is that the material is phonically based and proceeds up in level very gradually. There is plenty of repetition. The programme is also compatible with other instructional programmes. If one believes in Gillingham and Stillman's approach, for example (and many therapists still do), what this means is that 'The Tales of Jud the Rat' material can be used to reinforce remedial teaching done within the Orton/Gillingham paradigm [208], teaching done using an analytical phonics approach (e.g.[209]), as well as teaching done within more modern phonologically based paradigms (e.g. [210]).

Given the potential for increase in time on task in reading using material which involves frequent repetition of phonic associations, there are also probable benefits at a neurological level. In addition, visual tracking is built into programme implementation and this is also likely to lead to probable benefits at a neurological level. In short, increased time on task would be likely to develop automaticity in reading, implying stronger associations at a central level. As the literature suggests that the directionality in these associations is two-way, automaticity at a central level would be likely to lead to positive results in reading more generally, and the studies reviewed in this chapter indicate that this is indeed likely to be the case.

Based on the literature, there are also a number of other probable reasons for positive results. One is that 'The Tales of Jud the Rat' materials are repetitive, and take into account visual attention as well as visual features of text [211, 212]. The ebooks are set in large print and make use of short sentences and paragraphs as well as large amounts of white space on the page. What this means is that the material is likely to avoid crowding, which has been emerging in the literature as a feature affecting dyslexics on a visual level (e.g. [213, 214]). In addition, there

are theoretical reasons why a combination of phonically based material and large print would be helpful on a magnocellular level, especially in a situation in which both repetition of phonic associations and visual tracking are built into programme implementation.

However, it is important to state that there is no empirical evidence that this is actually so, and these theoretical bases of a programme remain possibilities until there is empirical evidence available to support assertions like these, or prove otherwise. Though the results presented in this chapter are positive, they are small-scale and preliminary. In addition, there are many weaknesses in data from pre-test, post-test and pre-experimental designs, especially when these designs are used clinically. Specifically, difficulties in weak research designs are likely to be compounded where therapy or instruction is undertaken with the aim of improving test scores and where a variety of teaching strategies are used to do so.

As they are based on clinical evidence and case study, the results presented in this chapter are positive but difficult to disaggregate, and larger-scale comparative research would be necessary to do so. Nevertheless, the clinical evidence presented is recurrent and indicates that there is likely to be benefit from using the materials even in the absence of both longitudinal and/or comparative studies. The value of both partner reading and peer tutored reading as well as parental involvement in assisting children with their reading is already clear from the literature (e.g. [215, 216, 217, 218, 219]). This is essentially what 'The Tales of Jud the Rat' programme provides, and the evaluative issue may thus not be whether this particular method is better than any other, but whether it is able to provide an appropriately structured and low-cost way for parents or peer tutors to achieve improvements in reading fluency.

The results we have obtained would support the indications in the literature of the value of increasing the amount that children read, as well as providing exposure to accessible texts. As Fisher and Berliner [220] have suggested, the amount that students read in classrooms is critically related to their reading achievement. In addition, Hiebert and Fisher [221] have suggested that children of lower primary school age performing in the bottom quartile require the following experiences with text:

Accessible Text

Provision of text which is accessible through being decodable, which includes both high-imagery and high-frequency words, which limits the number of unique words per text, and which repeats key words.

Increased Text

Provision of increased opportunities for reading involving exposure to text during classroom instruction, with the aims of increasing both word recognition and fluent reading skills.

Repeated Text

Provision of opportunities for repeated reading of text, with the aims of increasing exposure to new words and developing reading fluency.

The evidence from my practice would suggest the value of providing greatly increased time on task in reading accessible, graded texts using a methodology combining repetition with

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visual tracking. Both parents and children in my practice report steady improvement in reading fluency, and evaluate the 'Tales of Jud the Rat' reading fluency materials positively Positive qualitative evaluations have been accompanied by the changes in test scores presented in Tables 3 and 4 in this chapter.

The evidence from my practice would also support Hiebert and Martin's [222] comment that repetition has been the forgotten variable in reading instruction. Both parents and therapists have commented positively on the phonic structure of the programme as well as the use of repetition within the texts as well as in the methodology used in implementing the programme. It is also of interest that, despite the large amount of repetition which is a feature of the programme, the stories have been rated as entertaining by both children and their parents.

There have also been wider benefits. One parent reports that her child receives the books. His older sister then reads them. The family's domestic help then reads them, and her children then also use them to learn to read. The ebooks are also currently being used as the basis for reading fluency programmes being implemented with ten higher- and twenty lower-income families in Mpumalanga province. I await the results of these pilot programmes with interest.

In summary, I have found in my own work that 'The Tales of Jud the Rat' material provides a way of enabling parents to provide graded daily reinforcement of reading, by using ebooks which target reading fluency and automaticity in decoding at home. The majority of the children I work with have reading difficulties, and in this context 'The Tales of Jud the Rat' programme has been very helpful.

In implementing the programme, clear guidelines are given to parents in how to engage productively in improving the reading fluency of their children, and this enables me to ensure that time on task in reading is increased at home. The involvement of parents then leaves me with more time to focus in therapy on programmes which improve other aspects of reading and writing ability. These include programmes for developing synthetic and analytical phonic skills and word attack, as well as tasks involving oral and written language skills designed to build oral and written language comprehension skills. I am also able to spend more time in assessment and counselling of children and parents, as well as in working on programmes for developing skills in silent reading, as well as word analysis, single word spelling and sequential writing and spelling.

What can be claimed is that a great deal of material in 'The Tales of Jud the Rat' programme is already available but I am still developing parts of it, and also revising aspects of the material where formative evaluation has shown that this is necessary. It can also be claimed that the programme has provided clear benefits based on observable differences as well as changes in test scores. Based on positive evaluations, the materials are being added to, but are already in a form in which they can be used by others.

The number of families using the programme has increased rapidly, and the material may also have wider relevance for use in the classroom. Low-cost material of this type is often difficult to obtain especially in developing world contexts, or where parents, teachers and therapists live at distance from major towns or from educational bookshops. Positive results with the 'Tales of Jud the Rat' series so far suggest that the material provides a low-cost path to reading improvement which can be used in direct contact or at distance by parents, peer tutors, teachers, therapists and schools.

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